CLAIMS

1. A process for preparing a vinyl polymer containing halogen atoms in an amount of 1,000 mg or less per kilogram, the process comprising the dehalogenation step of heating a vinyl polymer containing the halogen at a temperature in the range of 140 to 250°C to dehalogenate the vinyl polymer, the vinyl polymer being produced by atom transfer radical polymerization of a vinyl monomer.

2. The process according to Claim 1, wherein the dehalogenation step is performed by promoting an intramolecular cyclization reaction of the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer.

3. The process according to Claim 2, wherein the intramolecular cyclization reaction forms a lactone ring.

4. The process according to any one of Claims 1 to 3, wherein the dehalogenation step is performed by removing an organic halide from the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer.

5. The process according to any one of Claims 1 to 4,

wherein the heating is performed in the presence of an inorganic adsorbent.

6. The process according to any one of Claims 1 to 5, wherein the heating is performed under reduced pressure.

7. The process according to any one of Claims 1 to 6, wherein the heating is performed in the presence of an oxygen radical scavenger and/or a carbon radical scavenger.

8. The process according to any one of Claims 1 to 7, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer has a group expressed by general formula (B):

$$-C(R^1)(R^2)-CH_2-CH(X)- \quad (B),$$

(where R^1 and R^2 each represent a group bonding to an ethylenically unsaturated group of the vinyl monomer, and X represents chlorine, bromine, or iodine).

9. The process according to any one of Claims 1 to 8, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer has a group expressed by general formula (D):

$$-C(R^{50})(CO_2R^{51})-CH_2-CH(X)-CH(R^{52})-R^{53} \quad (D)$$

(where X represents chlorine, bromine, or iodine; R^{50}

represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom; R^{52} represents a hydrogen atom, a hydroxy group, or an organic group; and R^{53} represents a hydrogen atom, a hydroxy group, or an organic group).

10. The process according to any one of Claims 1 to 9, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer is a mixture of a vinyl polymer having a group expressed by general formula (C) and a vinyl polymer having a group expressed by general formula (D), and the molar ratio [mole number of the group expressed by general formula (C)]/[mole number of the group expressed by general formula (D)] is in the range of 0.01 to 0.2:

$$-C(R^{50})(CO_2R^{51})-(X) \qquad (C)$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom):

$$-C(R^{50})(CO_2R^{51})-CH_2-CH(X)-CH(R^{52})-R^{53} \qquad (D)$$

(where X represents chlorine, bromine, or iodine; R^{50}

represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom; R^{52} represents a hydrogen atom, a hydroxy group, or an organic group; and R^{53} represents a hydrogen atom, a hydroxy group, or an organic group).

11. The process according to any one of Claims 1 to 10, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer is a mixture of a vinyl polymer having a group expressed by general formula (C) and a vinyl polymer having a group expressed by general formula (D), and the content of the group expressed by general formula (C) is in the range of 0.1 to 10 mmol per kilogram of the mixture:

$$-C(R^{50})(CO_2R^{51})-(X) \qquad (C)$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom):

$$-C(R^{50})(CO_2R^{51})-CH_2-CH(X)-CH(R^{52})-R^{53} \qquad (D)$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a

carbon number in the range of 1 to 10; R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom; R^{52} represents a hydrogen atom, a hydroxy group, or an organic group; and R^{53} represents a hydrogen atom, a hydroxy group, or an organic group).

12. The process according to any one of Claims 1 to 11, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer has a terminus transformed into a γ-halocarboxylic acid structure, a γ-halocarboxylate structure, or a γ-haloester structure by a reaction of a vinyl polymer containing the halogen at a terminus thereof produced by atom transfer radical polymerization of a vinyl monomer with a compound having at least one ethylenically unsaturated group in the molecule thereof.

13. The process according to any one of Claims 1 to 12, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization has a terminus transformed into a group expressed by general formula (D) by a reaction of a vinyl polymer having a group expressed by general formula (C) at a terminus thereof produced by atom transfer radical polymerization of a vinyl monomer with a

compound having at least one ethylenically unsaturated group in the molecule thereof:

$$-C(R^{50})(CO_2R^{51})-(X) \qquad (C)$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom):

$$-C(R^{50})(CO_2R^{51})-CH_2-CH(X)-CH(R^{52})-R^{53} \qquad (D)$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom; R^{52} represents a hydrogen atom, a hydroxy group, or an organic group; and R^{53} represents a hydrogen atom, a hydroxy group, or an organic group).

14. The process according to Claim 12 or 13, wherein the compound having at least one ethylenically unsaturated group in the molecule is a nonconjugated diene.

15. The process according to any one of Claims 1 to 14, the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer is

a (meth)acrylic polymer.

16. The process according to any one of Claims 1 to 15, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer has at least one ethylenically unsaturated group or at least one hydroxy group in the molecule thereof.

17. The process according to any one of Claims 1 to 16, wherein the vinyl polymer containing the halogen produced by the atom transfer radical polymerization of the vinyl monomer has a number average molecular weight in the range of 1,000 to 100,000.

18. The process according to any one of Claims 1 to 17, wherein the molecular weight distribution (weight average molecular weight/number average molecular weight) of the vinyl polymer containing a halogen produced by atom transfer radical polymerization of a vinyl monomer is in the range of 1.05 to 1.50.

19. The process according to any one of Claims 1 to 18, further comprising the step of removing insoluble contents from the vinyl polymer prepared through the dehalogenation step.

20. The process according to Claim 19, wherein the step of removing insoluble contents is performed by solid-liquid separation by means of filtration and/or sedimentation.

21. The process according to Claim 19 or 20, wherein the step of removing insoluble contents is performed by solid-liquid separation by means of filtration using a filter aid.

22. A vinyl polymer prepared by the process as set forth in any one of Claims 1 to 21.

23. The vinyl polymer according to Claim 22, wherein the vinyl polymer has a number average molecular weight in the range of 1,000 to 100,000.

24. The vinyl polymer according to Claim 22 or 23, wherein the molecular weight distribution (weight average molecular weight/number average molecular weight) of the vinyl polymer is in the range of 1.05 to 1.50.

25. The vinyl polymer according to any one of Claims 22 to 24, wherein the vinyl polymer has an ethylenically unsaturated group in the molecule thereof.

26. A hydrosilylation-reactive curable composition containing the vinyl polymer as set forth in any one of Claims 22 to 25.

27. A vinyl polymer having a silyl group in the molecule thereof, the vinyl polymer being prepared by allowing the ethylenically unsaturated group of the vinyl polymer as set forth in Claim 25 to react with a compound containing a hydrosilyl group.

28. The vinyl polymer having a silyl group in the molecule thereof according to Claim 27, wherein the vinyl polymer has a number average molecular weight in the range of 1,000 to 100,000.

29. The vinyl polymer having a silyl group in the molecule thereof according to Claim 27 or 28, wherein the molecular weight distribution (weight average molecular weight/number average molecular weight) of the vinyl polymer is in the range of 1.05 to 1.50.

30. The vinyl polymer having a silyl group in the molecule thereof according to any one of Claims 27 to 29, wherein the storage stability thereof is improved.

31. A curable composition containing the vinyl polymer having a silyl group in the molecule thereof as set forth in any one of Claims 27 to 30.

32. A method for determining the number of groups expressed by general formula (C) per one molecule of a vinyl polymer produced by atom transfer radical polymerization, the method comprising the steps of: replacing the halogen of the group expressed by general formula (C) of the vinyl polymer with a carboxylate containing a group capable of being detected by an analyzer; and determining the detectable group with the analyzer:

$$-C(R^{50})(CO_2R^{51})-X \qquad (C),$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom).

33. A method for determining the amount of the group expressed by general formula (C) per a unit weight of a vinyl polymer produced by atom transfer radical polymerization, the method comprising the steps of: replacing the halogen of the group expressed by general formula (C) of the vinyl polymer with a carboxylate

containing a group capable of being detected by an analyzer; and determining the detectable group with the analyzer:

$$-C(R^{50})(CO_2R^{51})-X \qquad (C),$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom).

34. The method according to Claim 32 or 33, wherein the method determines the amount of the group expressed by general formula (C) contained in a mixture of a vinyl polymer having a group expressed by general formula (C) and a vinyl polymer having a group expressed by general formula (D):

$$-C(R^{50})(CO_2R^{51})-X \qquad (C),$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; and R^{51} represents a hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom):

$$-C(R^{50})(CO_2R^{51})-CH_2-CH(X)-CH(R^{52})-R^{53} \qquad (D),$$

(where X represents chlorine, bromine, or iodine; R^{50} represents a hydrogen atom or an organic group having a carbon number in the range of 1 to 10; R^{51} represents a

hydrogen atom, an organic group having a carbon number in the range of 1 to 20, or an alkali metal atom; R^{52} represents a hydrogen atom, a hydroxy group, or an organic group; and R^{53} represents a hydrogen atom, a hydroxy group, or an organic group.

35. The method according to any one of Claims 32 to 34, wherein at least two types of analyzer are used.

36. The method according to any one of Claims 32 to 35, wherein the determination is performed by using nuclear magnetic resonance spectroscopy (NMR) and gel permeation chromatography (GPC).